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ABSTRACT

Student differences in attributions and motivation toward the study of high school Regents Earth Science were investigated through a naturalistic classroom study. Subjects were 72 ninth-graders in a rural New York high school. A shift in student attributions regarding success or failure in the class was facilitated by introducing an instructional intervention of an Earth Science unit with a criterion of 100% mastery. In particular, the shift in attributions of low achieving students toward the controllable factor "effort" was studied, and gender differences in attribution shifts were noted, with a higher percentage of female students showing shifts in attributions toward effort than males. These attribution shifts and introduction of the mastery unit are related to achievement in the course. The relevance of these findings are discussed in regard to improving the level and quality of science understanding for a broader ability range of high school students. Appendixes include a schedule for data collection, a student attitude questionnaire, and test results. (5 tables/figures) (Author)

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Abstract

Student differences in attributions and motivation toward the study of high school Regents Earth Science was investigated through a naturalistic classroom study. A shift in students attributions regarding success or failure in the class was facilitated by introducing an instructional intervention of an Earth Science unit with a criteria of 100% mastery. In particular, the shift in attributions of low achieving students toward the controllable factor "effort" was studied, and gender differences in attribution shifts are noted, with a higher percentage of female students showing shifts in attributions toward effort than males. These attribution shifts and introduction of the mastery unit are related to achievement in the course. The relevance of these findings are discussed in regard to improving the level and quality of science understanding for a broader ability range of high school students.

Student Differences in Attributions and Motivation Toward the Study of High School Regents Earth Science

The results of a recent study by the National Assessment of Educational Progress (NAEP) indicate that the level of understanding of scientific information among students is "distressingly low" (Rothman, 1988). As a result, major science groups (e.g., The American Association for the Advancement of Science) have called for curricular revisions and teaching reforms to increase students' motivation to study and learn science (Rothman, 1989). One rural school district in upstate New York is attempting to improve the level of students' achievement and attitude toward the study of science by placing a higher percentage of their high school students into Regents Science classes[1]. Many of these students were formerly place in non-Regents classes and as a result were denied access to more demanding and informative science. From 1987 to 1989, this school increased from 40% to 70% the number of ninth grade students enrolled in Regents science classes. Thus, the Earth Science teacher found a larger number of students in her Regents Earth Science classes that formerly would not have taken a Regents class due to either their lower achievement levels in their middle school science class, or lack of personal desire to take a "hard" Regents class. The Regents

classes are now composed of students with a much wider range of abilities and attitudes than was the case before 1987. Many students who had difficulty passing eighth grade science and with low academic self-esteem and attitudes toward studying science are now placed with students of high ability and interest.

The attribution theory of motivation (Bar-Tal, 1978; Brophy, 1987; Graham, 1984; Weiner, 1974, 1979, 1980) provides a theoretical framework which links students' thoughts and motivations with (un)successful academic achievement. Students who are usually successful on academic tasks often attribute their success to ability and effort, and their failure to lack of effort, a controllable internal factor, which provides hope of future success and thus motivation to put forth more effort on future tasks. However, students who are usually unsuccessful on academic tasks attribute their failure to lack of ability, and their success to luck or easy task requirements (uncontrollable external factors), and thus, become less motivated and are unlikely to risk putting forth more effort since it places their self-worth at risk (Covington, 1984). Although classroom applications have been suggested for improving low achieving students motivation to learn based on attribution principles (Brophy, 1983; Graham, 1984; Hunter & Barker, 1987) few research studies of these principles are based on typical academic tasks in naturally occurring classrooms and

none apply to high school science classes. Due to the fact that more and more students were being placed in Regents Earth Science classes and because of the interest in testing attribution principles in the realities of the classroom, a naturalistic study was designed.

In order to better understand and investigate how it might be possible to shift the attributions of students with prior low achievement in science away from uncontrollable or external factors (e.g., lack of ability, luck, task difficulty) towards controllable internal factors (e.g., effort), an instructional intervention was planned for the Regents Earth Science classes. It was hypothesized that this would help to facilitate this attribution shift. Hopefully, this would increase the chances that low ability/low academic self concept students would finish the course and receive "Regents" credit. It was further hypothesized that if the instructional intervention helped these students to shift their attribution of low science achievement away from the stable factor "ability", to the unstable and controllable factor "effort", then there would be a corresponding increase in subsequent "effort" by these students (e.g., increase in study time and homework assignments, seeking additional help from the teacher or successful students). Furthermore, this increase in expanded effort should produce a higher success rate on the Regents exam.

The instructional intervention was based on a modified mastery learning unit in which all students were required to achieve a perfect 100% on a test over one of the more difficult units in the Regents Earth Science curriculum. For those students not reaching mastery, corrective instruction was made available to students (e.g., peer tutoring, additional worksheets, extra help from the teacher) (Block, Efthim, & Burns, 1989). Although students were encouraged to seek corrective instruction it was their decision as to what type, when and how often. By requiring students to achieve a "perfect" score, extended effort would be required of all students, both high and low ability students. A topic was chosen so that success would have to be related to effort by eliminating other possible attribution explanations. The topic of the unit was constructing a Water Budget which eliminated task ease as a possible explanation for success since it was a one of the more difficult units of the Regents Earth Science curriculum (one that in previous years many students were unsuccessful on the Regents Exam). Due to the complexity, highly analytic and detailed nature of constructing a Water Budget Table, and the necessity of getting a 100%, it was also apparent that luck could be ruled out as a causal factor for success. Although innate ability could not be controlled, and differences in problem-solving and analytic skills differed among students, this water budget topic was one in

which prior knowledge would not play a role since it was new to all students. Thus, effort, in the form of study time and homework and class assignments, would be the only primary factor left to attribute success on mastering the water budget unit.

METHOD

Subjects

During the 1989-90 school year 70% of the entering ninth grade students in a rural New York public high school were enrolled in Regent science classes. Seventy-two of these students were enrolled in three sections of Regents Earth Science. Period 1 class had 12 male and 12 female students. Period 4 class had 14 male and 9 female students. Period 7 had 9 male and 16 female students. These students were intermixed for Regent Earth Science lab classes during 2nd, 5th, and 9th periods. One teacher, with four years high school experience, taught all the Regents Earth Science classes and labs. All students had taken general science in eighth grade, most who passed the course, a few who failed. Thus, all the Regents Earth Science classes were heterogeneously mixed by ability.

Data Collection

Procedures. Data were collected in four primary phases. Phase one consisted of administering a science questionnaire to all subjects the first day of instruction

in January. This was to obtain attribution and attitude data on students before the instructional intervention unit was taught. Phase two focused primarily on the 7th Period class and ran for approximately two weeks from January 3rd to January 16th, 1990. Phase three focused primarily on the 1st Period class and ran for approximately two weeks from February 6th to February 22nd, 1990. Phase four consisted of collecting end-of-the year data on class achievement and New York Regents Exam scores in July of 1990. Between phase two and phase three students took school midterms (January 18-22), a mid-year New York State Regents competency exam (January 23-26), and had three school days cancelled due to snow (January 29-30, February 2). In phase two, the 7th Period class was taught the Water Budget mastery unit as the first unit after the holiday vacation. This enabled students to have ample opportunities to take several formative tests over the unit and receive necessary corrective instruction before the midterms. Data were collected by recording classroom observations, conducting student interviews, recording test scores and dates, and noting homework achievement and quality of completion. In phase three, the 1st Period and 4th Period classes were taught the Water Budget mastery unit as the first complete unit after the school and state midterms were taken and midterm report cards were distributed. Data were collected on the 1st Period class through classroom observations,

student interviews, and test scores along with dates. Minimal observation and interview data were collected on the 4th Period class due to limited resources (see Appendix A).

Science Questionnaire. The science questionnaire collected data on students' attributions toward success and failure on science tests and homework; study efforts; academic self-concept regarding science; and attitudes toward science and studying science (see Appendix B).

Classroom Observations. Two paid research assistants were trained to observe and record the behaviors and comments of students and the teacher during the instruction of the Water Budget mastery unit. One was assigned to observe 7th Period during phase two, the other to observe 1st Period during phase three. This included observing five consecutive days of classes commencing on the day the Water Budget instruction began, along with the labs that followed that class period. In addition, the observers returned to observe their respective classes three additional times during the following couple of weeks. Observations were recorded with particular focus on students' effort attempts, studying behaviors, and verbal attribution comments of the students and the teacher (see Appendix C). Particular attention was directed to observing shifts in attribution behaviors or statements before and after the Water Budget mastery unit was taught and before and after the midterms.

Student Interviews. The two research assistants

interviewed a total of 41 students (21 from 7th period; 19 from 1st period, 1 from 4th period). Although a strict interview schedule was not used, students were asked about the same general topics (see Appendix D for list of questions from which interviewers could draw to facilitate the interviews). The order of the questions would vary and additional spontaneous questions were asked depending on students responses. The attempt was to get the students to freely talk about their perceptions about the Regents Earth Science class, attributions for success and failure in the class, their views on the Water Budget unit, and the influence of the teacher and her instruction on their success in the class. Each research assistant interviewed students from the class that she observed in order to be able to ask questions regarding behaviors that she had observed in each student's class. This allowed us to obtain students' perceptions, in addition to the observer's perceptions, of those behaviors. These taped interviews were later transcribed and typed.

Mastery Test Scores and Dates. A record was kept for each student listing the date and score obtained on the mastery test for the Water Budget (see Appendix E). There were two formal class administrations of the test for each class, followed by individual administration of the test during the teacher's study hall, preparation period, lunch, and before and after school in the teacher's classroom.

Homework Achievement & Effort. For the 7th period class, additional data were collected on achievement and effort levels on three advanced water budget homework assignments. These assignments followed the first mastery test administration and the subsequent posting of the names of the students who obtained a perfect (59/59) score (see Appendix F). These assignments included one on constructing a water budget chart, a second on constructing a graph from information calculated on the chart, and a third on questions related to the water budget topic. The teacher evaluated both the achievement (A) and effort (E) of students on these assignments.

Teacher Log. The teacher kept a daily log of what she thought was important about her instruction of the mastery unit on the water budget and students' response to it (see Appendix G for an example entry). In particular she recorded instances of students seeking her out for additional help on the water budget unit, as well as on subsequent lessons.

Semester, Midterm, Final and Regents Test Scores. Students report card grades for each term, midterm and final class exam scores, and the scores students received on the Regents Earth Science exam were collected in July when they became available.

By obtaining data from multiple sources it was possible, by "triangulation", to ensure greater validity of

data interpretation by checking data items against several sources (LeCompte & Goetz, 1982; Miles & Huberman, 1984).

Data Analysis

Data from all the above sources were analyzed and synthesized by constructing very large matrices (approximately 3 ft. x 6 ft.) for each class. The left margin listed individual students names and the top margin the days school was in session. The internal cells contained the data obtained for a particular student on a particular day from all the data sources (see Appendix H for an example portion of a matrix). This allowed for analysis across time for each student and between students both within and across classes. This provided a short "motivation" history for each student. By comparing students attributions and behaviors as they progressed through this history encountering the instructional intervention mastery unit, midterms, additional Earth Science assignments, and finally, the Regents Earth Science exam, results were obtained related to the degree in which students' motivation and attributions for success changed.

RESULTS[2]

A primary concern of this study was to see if there would be a shift in low-achieving students attributions and levels of motivation after the presentation of the mastery instructional unit. There was. After all data were

collected, low achieving students (LAS) were identified by calculating first semester grades and defining "low achievers" as those students with averages (AVE) below 75. In the Period 7 class this was 9 out of 25 students (the lowest 36%); and in the Period 1 class 9 out of 24 (the lowest 38%), or by first semester results, approximately the bottom 1/3 of each class. Once these students were identified, it was possible, by reviewing the history of each student (as detailed on the data matrices), to see if there was a difference in their attributions and motivation efforts before and after the intervention of the mastery unit.

As can be seen in Table 1, six of the nine low achievers (66%) in Period 7 had a positive shift (+) away from attribution factors such as luck, task difficulty, and lack of ability, toward attributing effort as the primary factor for success or failure. Two students had the opposite shift (-), i.e., away from effort toward attributing success and failure to factors such as lack of ability and task difficulty. With one student there was no apparent change (nc).

Table 1 about here

As illustrated in Table 2, five of the nine students (56%) in Period 1 had a positive shift in attribution or motivation with four students showing no change.

Table 2 about here

In closely reviewing the data, it appears that for the students in the Period 7 class the shift in attributions and effort motivation occurred after the mastery unit. Both low and high achieving students (52% overall) mentioned the mastery unit as an influence on their increased efforts in studying Earth Science. However, in the Period 1 class the shift in attributions occurred less frequently (25%) and when it occurred it was often difficult to determine if it was due to the mastery unit or due to having recently received midterm results. Another confounding factor was the fact that since Period 1 students shared labs with Period 7 students, Period 1 students heard about the difficulty of the water budget mastery learning unit and 100% criteria five weeks before they began the unit. As a result, it appears that this information may have influenced the initial study efforts of the Period 1 class on the water budget unit as can be seen in the different achievement levels between the two classes on the first two mastery tests (see Figure 1). One result of this difference was

that in the 7th Period class many of the high ability/achievement students did not reach 100% mastery until their second or third effort. Thus low ability/low achievers in this class could see that it wasn't just ability that accounted for reaching successful mastery. In fact, due to their extended efforts, some of the low achievers reached the 100% criteria before some of the high achievers. This further influenced low achievers viewing effort as a primary attribute for success. However, in the 1st Period class, a majority of the high ability students reached mastery on the first attempt, and all by the second attempt. Thus, none of the low achievers in this class had the opportunity to experience "mastery" before any of the high achievers.

Figure 1 about here

A second purpose of this study was to see if the intervention of this mastery unit would not only create changes in attributions of low achieving students, but also to see if this might have an influence on the Regents Earth Science exam and final course grades. It appears that for some it might have (see Table 3). Sixteen (89%) of the low achieving students raised their class average after the mastery unit was taught, the other two maintained the same average. Ten of these sixteen students were students in

which positive attribution changes occurred and motivation efforts increased. Looking at the Regents scores, only 44% (4 out of 9) of the 7th Period low achieving students passed, but 89% (8 out of 9) of the 1st Period students passed. In other words, 67% of the total 18 low achieving students passed the Regents exam. Of the 12 students who passed, 8 of them had shown positive attribution shifts.

Table 3 about here

A third finding of the study was that there was a marked gender difference in the percentage of students who had positive "effort" attribution shifts. In the 7th Period class, 70% of the female students showed a positive shift compared to only 33% of the male students (see Figure 2). Of the remaining five female students, two had negative attribution shifts (away from effort), two had no change (constant effort attributions) and for one there was insufficient data due to absence from school. For the remaining six male students, three had no change due to constant high ability attributions, one had no change due to constant effort attributions, and there were insufficient data for the other two due to frequent absences from school.

Figure 2 about here

In the 1st period class 50% of the female students had a positive "effort" attribution shifts compared to only 25% of the male students. Of the remaining six female students there was no shift with five who maintained a constant effort attribution, and one who maintained a constant ability attribution. For the remaining nine males, one had a negative shift in effort attribution, and the other eight exhibited no change with four students maintaining a constant effort attribution and four maintaining a constant ability attribution. (As noted previously, one reason for the lower percentage change for the 1st period class compared to the 7th period class was the prior knowledge the 1st period students gained by being in labs with 7th period students who encountered the water budget unit several weeks earlier).

Finally, the personal and professional characteristics of the teacher influenced students' views of effort as a primary attribute for their success or failure in the Earth Science classes. The teacher was keenly interested in motivating the students to learn and achieve. She was particularly concerned with ensuring that the low achieving students placed in Regents Earth Science classes would be prepared for the Regents exam at the end of the year. From the beginning of the school year she stressed the importance of effort by students on homework and class assignments for success. Both research observers and most students

interviewed (78%) specifically mentioned the teacher as a motivator. Here are some of the comments made by students during the interviews:

JM: "...getting a 100 is what you would expect"

BM: "...works with all students to help them"

RD: "...keeps after you and makes you learn"

BC: "...has high expectations for everyone."

JM: "...has high expectations and teaches a lot"

CV: "...is available for extra help"

JC: "...pushes you to do it"

JD: "...cares if you learn"

EM: "...teaches you good"

TM: "...makes you work hard, it pays off"

DP: "...makes you understand"

Students would say that she was a "hard" teacher but they enjoyed her class. One research observer noted that the teacher was very "businesslike" and well organized with an established routine and focused on helping all students learn. It was common for her to call on over 75% of the students during each class period and involve them in learning. She had excellent questioning skills and techniques as indicated in the following observation note:

> (the teacher) frequently leads students to the correct answers through the questions she asks. She has the knack of remembering who is having problems with particular material and will specifically address her questions on that material to the corresponding student. Several lower-achieving students

> have commented on (this) questioning technique in the interviews. They seemed to appreciate her help in getting them to understand the material. It appeared to be another indication that if they put in the effort, they could do well.

It should be noted that in reviewing the data from the observations and the teacher's log, there was a dramatic increase in students' effort behaviors after the introduction of the water budget mastery unit. More homework was completed; more students sought out the teacher for extra help (some whom had never asked for help before); and a few students even asked for extra homework assignments to help prepare for a quiz.

CONCLUSION

This study would lend support to encouraging more students to take more demanding and higher level science courses (e.g., Regents) if supportive methods are used to provide opportunities for success that are clearly related to the effort put forth in mastering science concepts. If students have the opportunity to see that their efforts can have a "pay off", then they may make an attribution shift that is focused on their efforts rather than their perceived lack of ability. This is particularly important for students who are traditionally viewed as "low achievers." Furthermore, this study suggests that female students may be especially susceptible to this shift toward attributing

success to effort. This is important since female students are often less frequently found in upper high school courses which limits their opportunities for study at the college level and their career choices. It is interesting to note that the Assistant Secretary for Educational Research and Improvement of the U.S. Department of Education has recently stated that research on motivation should be one of our national priorities to transform classrooms into opportunities for developing students' minds rather than places where students are "going through the motions, sitting in classrooms unfazed by the technologies that have become commonplace" in our society (Cross, 1990, p.22). Helping to empower **all** students by showing them that they can have control over their academic success in science will help to reverse the trend of a "distressingly low" understanding of science of the world that surrounds them.

References

Block, J.H., Efthim, H.E., & Burns, R.B. (1989). *Building effective mastery learning schools.* New York: Longman.

Bar-Tal, D. (1978). Attributional analysis of achievement-related behavior. *Review of Educational Research, 48* (2), 259-272.

Brophy, J. (1983). *Conceptualizing student motivation* (Occasional Paper No. 70). East Lansing, MI: Institute for Research on Teaching, Michigan State University.

Brophy, J. (1987). Synthesis of research on strategies for motivating students to learn. *Educational Leadership, 45* (2), 40-48.

Covington, M.V. (1984). The self-worth of achievement motivation: Findings and Implications. *The Elementary School Journal, 85* (1), 5-20.

Cross, C.T. (1990). National goals: Four priorities for educational researchers. *Educational Researcher, 19* (8), 21-24.

Graham, S. (1984). Teacher feelings and student thoughts: An attributional approach to affect in the classroom. *The Elementary School Journal, 85* (1), 91-104.

Hunter, M. & Barker, G. (1987). "If at first...": Attributional theory in the classroom. *Educational Leadership, 45* (2), 50-53.

LeCompte, M.D. & Goetz, J.P. (1982). Problems of reliability and validity in ethnographic research. *Review of Educational Research, 52* (1), 31-60.

Miles, M.B. & Huberman, A.M. (1984). *Qualitative data analysis: A sourcebook of new methods.* Beverly Hills, CA: Sage.

Rothman, R. (1988). Science-achievement levels on test "distressingly low". *Education Week, 8* (4), 1,11.

Rothman, R. (1989). Science group unveils plan to revise curricula. *Education Week, 8* (23), 1,22-23.

Weiner, B. (1974). Motivational psychology and educational research. *Educational Psychologist, 11*, 96-101.

Weiner, B. (1979). A theory of motivation for some classroom experiences. *Journal of Educational Psychology, 71*, 3-25.

Weiner, B. (1980). "May I borrow your class notes?" An attributional analysis of judgements of help-giving in an achievement-related context. *Journal of Educational Psychology, 72*, 676-681.

Notes

[1]Regents classes have a more demanding curriculum than non-Regents classes. In order to receive "Regents" credit, students must successfully pass a standardized Regents Exam administered by the New York State Education Department.

[2]Only results relative to the 1st Period and 7th Period classes will be discussed since insufficient data were collected for the 4th Period class.

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APPENDIX A: Phases of Data Collection

Phase 1

1/2/90 Administration of *Science Questionnaire* to students

Phase 2

1/3/90 *Observation* of 7th Period class (& 9th Period lab) begins

Instruction on Water Budget mastery unit begins for 7th Period

1/4/90 *Observation* of 7th Period class continues

Instruction on Water Budget continues

1/5/90 *Observation* of 7th Period class continues

Instruction on Water Budget continues

1/8/90 *Observation* of 7th Period class continues

First mastery test on Water Budget unit

Instruction on Advanced Water Budget begins

Six (6) 7th Period students *interviewed*

1/9/90 *Observation* of 7th Period class continues

Two (2) 7th Period students *interviewed*

1/10/90 Second mastery test on Water Budget unit

1/11/90 *Observation* of 7th Period class continues

Four (4) 7th Period students *interviewed*

1/12/90 Lab Midterms for Regents Earth Science

1/16/90 *Observation* of 7th Period class continues

Nine (9) 7th Period students *interviewed*

2/6/90 *Observation* of 7th Period class ends

Phase 3

2/8/90 *Observation* of 1st Period class (& 2nd Period lab) begins

Instruction on Water Budget mastery unit begins for 1st Period

2/9/90 *Observation* of 1st Period class continues

Instruction on Water Budget continues

2/12/90 *Observation* of 1st Period class continues

Instruction on Water Budget continues

2/13/90 *Observation* of 1st Period class continues

Instruction on Water Budget continues

2/14/90 *Observation* of 1st Period class continues

First mastery test on Water Budget unit

Instruction on Advanced Water Budget begins

Three (3) 1st Period students *interviewed*

2/15/90 *Observation* of 1st Period class continues

Five (5) 1st Period students *interviewed*

Three 1st Period students retake mastery test

2/21/90 Second mastery test on Water Budget unit

Four (4) 1st Period students *interviewed*

2/22/90 *Observation* of 1st Period class continues

Ten (10) 1st Period students *interviewed*

3/1/90 *Observation* of 1st Period class ends

Phase 4

7/5/90 Final Course Grades and Regent Exam scores obtained

APPENDIX B

Science Questionnaire

For each of the statements below **circle** only one answer that best describes what you think.

1.To get an "A" on a science homework assignment you have to

a. be lucky.
b. study hard.
c. be smart.
d. have an easy assignment.
e. be liked by the teacher.
f. get help from someone.

2. Each **week** I spend about the following amount of time doing science homework.

a. over 4 hours
b. 3 or 4 hours
c. 1 or 2 hours
d. less than 1 hour

3. Students Fail science tests because they

a. are not smart.
b. are not liked by the teacher.
c. had a bad day.
d. are not lucky.
e. did not study.
f. had a hard test.

4. When studying science I

a. usually like it.
b. sometimes like it and sometimes dislike it.
c. usually dislike it.

5. To get an "A" on a science test you have to

a. be liked by the teacher.
b. study hard.
c. get help from someone.
d. be lucky.
e. have an easy test.
f. be smart.

6. Most of the time I think of myself as

a. very good in science.
b. OK in science.
c. not very good in science.

7. When someone Fails a science homework assignment they

a. are unlucky.
b. have not studied enough.
c. are not liked by the teacher.
d. had too hard of an assignment.
e. are not smart enough.

8. When I do poorly on a science test I feel like

a. studying harder to do better.
b. studying about the same amount.
c. studying less since I did so poorly.

9. Of the almost 25 students in this class I would guess my rank according to grades in this science class is

(highest) (lowest)

1 2 3 4 5 6 7 8 9 10 12 13 14 15 16 17 19 20 21 22 23 24 25

10. Overall I

a. like science.
b. think science is OK.
c. hate science.

APPENDIX C: Illustrative Sample of Observation Notes

12:35 p.m.

The teacher helps all three students with the Syracuse and El Paso water tables. Jodi is further along with the Syracuse water table than the other two students. She works independent of the other two girls. Carol and Tonya B. work together on the water tables. The girls jointly use Carol's calculator to figure out the math in the problems. Carol asks the teacher if their answers are correct after she fills in any new information on the table or she keeps the teacher's attention while working through an entire column on the table constantly asking the teacher if this is right or what she should do now? Carol frequently comments that she doesn't know what she is doing.

Carol to the teacher: "We have a test on Monday and if we don't pass it, we have to take it over?"

Teacher: "Not the same test. A different test. And not just pass it Carol. You have to get a 100."

Carol to teacher: "I'll never get it. If you could help me with it I could do it." (Laughs)

Jodi: "Yeah, if you could help us, we could get a 100."

Carol to Tonya: "We have to get a 100. She (referring to the teacher) won't accept a 99. I'll never get a 100."

Jodi: "That's pretty neat, I can tell my parents that I got a 100 on a science test and they won't know that I had to get a 100."

Carol to me: "Why don't you come in and take it for me?"

Tonya: "I hate Earth Science."

Towards the end of completing the tables, Carol and Tonya are working more independently of each other. Tonya tends to lag behind Carol in completing the table. Tonya talks the least of the three girls. At one point the teacher says to Tonya that missing the first day of the unit instruction has really hurt her.

APPENDIX D: General Interview Questions

Before beginning interview ask for permission to record the interview.

* Ask for the students name, Earth Science class and lab periods.

* How do you feel about science classes?

* How do you compare 9th grade science with 8th grade science? Differences in amount and level of work?

* How did you do in 8th grade science?

* How are you doing in Regents Earth Science?

* What kind of teacher is Mrs. D?

* Tell me about the way Mrs. D teaches your Earth Science class?

* What do you think about the water budget unit? Compared to other units?

* How did you do on the water budget test?

* How do you feel about having to get a 100 on the water budget test? Do you think that everyone can get a 100?

* How did you prepare for the water budget test?

* Did (Will) you do anything differ to prepare for the second water budget test?

* How do you usually study for tests in Earth Science?

* What do you think about Earth Science labs?

* Do you work with a partner? How do you like working with a partner? How is your partner doing in Earth Science?

* Do you ever go to see the teacher outside of class to get extra help? (before, after school, study hall, etc.)

* What is your success in science due to? (study? ability? teacher bias? luck? effort? easy assignments and tests?)

* How did you do on your midterms?

* How did you study for your midterms?

APPENDIX E: Mastery test scores for water budget unit

Class: *7th period*
Test dates and scores (* = 59/59)

Student	1/8	10	12	16	2/1	2	5	6	7	12	13	14	15	21	22	26	27	3/1
TB	22	44			45							56	40		50	*		
JB	*																	
SB	*																	
CB	28	46		25								48			53		*	
DB	55	*																
DC	32	*																
BC	*																	
MD		11																
LF								30							*			
AG	51	57						58										*
NG	53	57				*												
MH	42	51						*										
ML	57	58		*														
JL	*																	
NM	*																	
CMa	*	*																
HM	56	*																
CMy	30	41	44	26	49			49			46			*				
TP	43	58								*								
KR	56	*																
JR	46	49				55	*											
KS	48	54	*															
TS	*																	
JV	53	*																
MW	51					56			*									

Class: *4th period*
Test dates and scores (* = 59/59)

Student	2/14	2/15	2/21	2/22	2/26	2/27	2/28	3/1
TA	*							
JB	56	*						
EB	55	*						
JD	*							
AD	*							
SD	*							
DD	*							
SD	*							
ME	58		58	*				
JH	51	*						
VJ	54		*					
SL	*							
CM	*							
SO	*							
WP	44		37	35	57	46	*	
BP			*					
WR	*							
JR			43				*	
JS	*							
CS	*							
BS	*							
BT	*							
RS	*							

Class: *1st period*
Test dates and scores (* = 59/59)

Student	2/14	2/15	2/21	2/22	2/27	2/28	3/1	3/2	3/9	3/13	3/15
BB	*										
MB	*										
JC	49		57						48	33	*
CC	40		51						54	*	
MC	*										
DC							*				
RD	*										
JD	57	*									
CF	51		*								
LF	58	*									
MH	*										
KJ	54		57		*						
RJ	*										
RM	*										
JM	*										
TM	*										
DN	*										
DP	*										
AR	53			39	49	56	55	*			
LS	56				*						
RS	*										
ES	*										
CV	58	58			*						
WW	*										

APPENDIX F: Advanced water budget homework (7th Period)

Student	Chart A	Chart E	Graph A	Graph E	Question A	Question E
TB	P	?	F	F	P	F
JB	G	G	G	G	G	G
SB	G	G	G	G	G	G
CB	P	G	F	G	G	G
DB	G	G	F	F	F	G
DC	G	G	G	G	F	G
BC	G	G	G	G	G	G
MD	---------ABSENT--------					
LF	---------ABSENT--------					
AG	G	G	G	G	F	G
NG	G	G	G	G	F	G
MH	F	F	F	G	F	G
ML	G	G	G	G	G	G
JL	G	G	G	G	G	G
NM	--------NOT DONE------					
CM	--------NOT DONE------					
HM	G	G	G	G	G	G
CM	G	G	G	G	F	G
TP	--------NOT DONE------					
KR	F	F	P	P	G	G
JR	F	G	F	F	P	F
KS	F	G	F	F	G	G
TS	G	G	G	G	G	G
JV	G	G	G	G	F	G
MW	---------ABSENT-------					

A = ACHIEVEMENT
E = EFFORT

G = GOOD
F = FAIR
P = POOR

APPENDIX G: Except from Teacher's Log

1/4/90

Chris M (7th) came into classroom before school to show me a computer program he wrote the night before that would fill in a water budget chart---one error in program---later in day he showed me the correction---had made an incorrect entry.

Group (7th class) is not yet ready for test.

Came for help:	Tonya B.	Carol
	Nicole	Marcy W.
	Brenda	Jodi
	Kevin	Tonya P.
	Tiffany	

1/5/90

Class (7th) appears to have a fair grasp on the material.

Came for help:	Danny	
	Clint	
	Mark	- had short question
	Jodi	" " "

1/8/90

Tiffany: "Hurry with the quiz before I forget"

Jon -	very confident			
Jodi -	"	"		
Chris -	knows he knows			
Darlene-	says she doesn't know			
Carol	"	"	"	"
Tonya P	"	"	"	"

APPENDIX H: Sample from synthesized data matrix

7th Period Date... Student	1/10/90	1/11/90	...
.	.	.	
.	.	.	
.	.	.	
DB	Expressed confidence before taking 2nd water budget test 100 on 2nd water budget test Good achievement and effort on advanced water budget homework	*Effort is needed to understand science.* *Everyone can get 100 if they study.* *Teacher influences students effort and motivation to study* Comes in to check test results before class. Is excited to see his name on the "100" list Teacher tells him that his study efforts paid of	
.	.	.	
.	.	.	
.	.	.	
JV	Felt confident about doing well on second water budget test Got 100 on 2nd w.b. test Good achievement and effort on advanced water budget homework Came in after school to check on w.b. test Was sure she had gotten a 100.	Comments to researcher in hall "Did you see that I got a 100 on the water budget test?"	
.	.	.	
.	.	.	
.	.	.	

Table 1

Changes in Period 7 Low-Achieving Students Attributions

LAS	AVE	Before Mastery Unit (success due to:)	After Mastery Unit (success due to:)	Shift
TB	68	task being easy	"with effort can get 100 on mastery test"	+
CB	71	ability, "smartness counts"	seeking extra help & putting in more effort	+
MD	50	effort & "help from friends"	"it was easy"	-
MH	65	effort	effort and study	nc
CMy	67	ability, "I'll never get 100"	a gradual increase in effort over time	+
TP	60	"effort put forth"	failure due to lack of ability, less confident	-
KR	71	ability, others are "smarter than me"	effort	+
JR	62	primarily ability (and effort)	primarily effort (and ability)	+
MW	67	says "effort" but little effort seen	large increase in effort behaviors	+

Table 2

Changes in Period 1 Low-Achieving Students Attributions

LAS	AVE	Before Mastery Unit (success due to:)	After Mastery Unit (success due to:)	Shift
JC	55	effort, failure due to lack of ability	effort and ability	nc
CC	57	getting help, failure due to lack of ability	effort and study	+
CF	63	ability, studies very little	"doing homework" increased effort	+
LF	75	effort, failure due to difficulty of task	effort	nc
JM	72	effort, failure due to lack of ability	effort, failure due to lack of effort	+
AR	57	effort & study, failure due to lack of ability	effort, failure due to lack of ability	nc
RS	73	effort, fail due to low ability/difficult task	ability & effort, "everyone can get 100"	+
CV	71	effort	effort	nc
WW	71	"easy assignment"	study & "effort put forth" "Everyone...100"	+

Figure 1. Percentage of student reaching 100% criteria on Water Budget mastery tests.

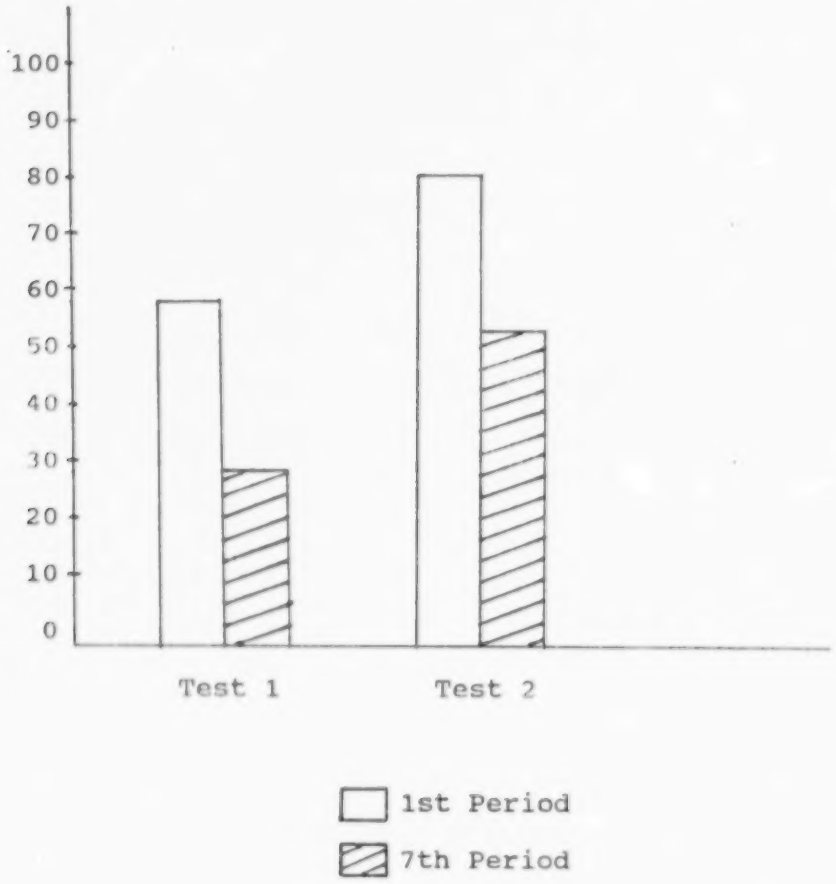

Table 3

Low Achievers averages and Regents scores (65% is passing)

Per.	LAS	Midterm Ave.	Final Ave.	Regents Score	Attr.
7	TB	68	71	**57**	+
7	CB	71	74	71	+
7	MD	50	**50**	did not take	-
7	MH	65	68	**54**	nc
7	CMy	67	70	**55**	+
7	TP	60	65	**37**	-
7	KR	71	71	75	+
7	JR	62	65	68	+
7	MW	67	73	68	+
1	JC	55	**59**	74	nc
1	CC	57	66	67	+
1	CF	63	67	**63**	+
1	LF	75	82	80	nc
1	JM	72	77	82	+
1	AR	57	66	66	nc
1	RS	73	78	84	+
1	CV	71	74	77	nc
1	WW	71	73	73	+

Figure 2. Percentage of students with positive "effort" attribution shifts.